which proves, at any rate, that $\dfrac{\delta n}{n}$ is a large fraction of $\dfrac{\delta N}{N}$. Also the ratio is increased if a positive value is assigned to δe.

In the same equation substitute the observed values

$$\frac{\delta N}{N} = -6 : 10^8 \qquad \frac{\delta N}{N} - \frac{\delta n}{n} = -6 : 10^9$$

(the factor 2 being introduced) then

$$\delta e = (\tfrac{6}{5}-k)\frac{2\cdot7}{10^7} = 0''\cdot01 \text{ per century if } k = 1$$

The supposition that the observed accelerations follow from the theory does not therefore conflict with the observed eccentricity.

On the other hand the transits of *Mercury* exhibit some slight evidence against this hypothesis, but perhaps not sufficiently important to destroy it.

Two conclusions follow from this paper :

I. It is absolutely wrong to assign an arbitrary secular acceleration to the Moon and none to the Sun, and to justify this course by the supposed action of the tides. This has been the practice of the *Nautical Almanac* since 1883.

II. On the hypothesis contained in this paper the rate at which the day is increasing is six parts in 10^8 or $0^s\cdot005$ per century. This is about ten times as large as previous estimates.

Observations of the Magnitudes and Position of Nova Geminorum
By E. E. Barnard.

This star was discovered by Professor H. H. Turner on a photograph taken at Oxford on 1903 March 16.

My work on the Nova has consisted of comparisons of its light with that of certain stars and measurements of its position relative to small stars near it. I have also watched the star for any change of focus due to the usual changes in the spectrum of a Nova. The star was at first of a strong red colour, but this soon faded out and left it colourless. At first there did not seem to be any difference in the focus from that of an ordinary star, but in the latter part of April there seemed to be some slight difference, the star perhaps coming to a focus slightly outside of that for an ordinary star (see *Ap. J.* xvii. 1903, p. 376). The notes show that on 1903 August 31 the Nova was whitish and hazy. On 1903 September 21 at $15^h\ 45^m$, with a magnifying power of 700 diameters, the Nova was decidedly out of focus when compared with the other stars. Careful measures

of the focus were made with reference to a 10th magnitude white star preceding.

Nova	... ...	2·54 inches (5 obs.)
10^m star ...	...	2·25 ,, (6 ,,)
Difference	...	0·29 inch

The focus for the Nova was therefore 0·29 inch further from the object-glass than for a star. On 1905 November 25, by slipping the eyepiece back and forth, the focus for the Nova seemed to be quite outside of that for a star, but the seeing was too bad to make any measure of it. Speaking of the focus of the Nova, there was one thing about it that I have never seen in the case of any other star. In experimenting with the focus on 1903 March 30 I found that the star really had two distinct foci, both of which gave sharp definite images, one of about the 8½ magnitude, of a reddish-yellow colour at the ordinary focus for a star, the other of the 10th magnitude 0·39 inch further out from the object-glass and of a beautiful crimson colour and 0″·1 in diameter. This last image was really the best defined of the two. In the first case there was an inconspicuous crimson halo about the star, and in the second a pale greyish-blue halo 3″·8 in diameter. Either of these images would readily have been taken for the true image of the star. On April 6 this crimson image was still present though not so strong and definite. On April 27 it had entirely disappeared. The out-of-focus image of the Nova then resembled that of an ordinary star. On account of cloudy weather it had not been possible to tell just when this change took place. I understand that this crimson image was due to the strong Hα line in the spectrum of the star. When the other stars were examined outside and inside the focus no such peculiarity was seen.

Mr. Parkhurst had secured a photograph, 1903 February 21, with the 2-foot reflector of the region of the Nova. On this plate a faint star was shown close to the position afterwards occupied by the Nova; this small star, however, was near the edge of the plate where spherical aberration made it difficult to measure with accuracy. It was thought that this might be the Nova before it became bright. When the Nova had faded sufficiently, however, to permit one to see a faint object near it, I found on the morning of 1904 September 1 that the small star itself could be seen close preceding the Nova. Measures of the position of this star with respect to the Nova are given in the list of measures that follows.

A few of these measures were given in *Ap. J.* xvii. 1903, pp. 301, 302. In those measures, however, the magnitudes assigned the small stars were only rough, simply to aid in the identification of the stars. On two dates since then I have carefully estimated their magnitudes. This is rather important because these estimations are on the same scale that I have used throughout

in my measures of the small stars in the globular clusters. These estimations are given below :

Direct Estimates of the Magnitudes of Small Stars near Nova Geminorum.

	1903 Oct. 26. m	1904 Dec. 5. m	Mean. m			1903 Oct. 26. m	1904 Dec. 5. m	Mean. m
1	13·0	13·5	13·2		5	12·8	12·6	12·7
2	13·8	14·2	14·0		6	12·8	13·4	13·1
3	15·0	14·5	14 7		7	...	...	15·1
4	12·8	12·5	12·7					

The magnitudes of five of these stars have been determined photometrically by Mr. Parkhurst. They are :

	m			m
1	13·29		6	13·11
3	14·84		7	15·27
5	13·00			

In *Ap. J.* xvii. 1903, pp. 376, 377, I have given my determinations of the magnitudes of the Nova from 1903 March 27 to May 19. To make the present paper more complete I will give here these results, which depend on stars whose magnitudes were photometrically determined by Mr. Parkhurst. They are based on the Harvard system. The observations of May 23 and 27 were not printed in the *Ap. J.*

Observed Magnitudes of Nova Geminorum.

1903		Central Standard Time. h m	Mags.		1903.		Central Standard Time. h m	Mags.
March	27	12 30	8·00		April	26	8 30	9·81
	29	9 0	8 81			27	8 30	9·96
	30	9 0	8·82			28	8 30	10·18
	31	7 20	8·84		May	3	8 20	9·80
April	3	8 0	8·96			6	8 10	9 80
	4	7 40	9·04			7	9 10	9·87
	6	9 0	9·15			8	8 30	9·77
	7	10 20	9·22			10	8 10	9·77
	9	8 0	9·12			18	8 30	10·02
	16	7 40	9·12			19	8 30	10·07
	17	9 0	9·20			23	8 30	10·05
	22	7 50	9·20			27	8 50	10·05
	24	8 15	9 92					

At the observation of March 27 the star was very low and the estimated magnitude is unreliable. A direct estimate made it 8·2 magnitude. It was estimated to be 0·2 magnitude less than B.D. +29°, 1342.

Magnitudes of the Nova when Faint.

1903.	h m	m		1904.	h m	m
Aug. 31	16 25	12± } Rough		Oct. 17	14 0	13·7
Sept. 1	16 0	11± } estimate		Nov. 12	13 40	13·8
Oct. 13	14 30	12·3		21	17 40	14·4
26	14 30	12·3		26	11 40	14·5
27	14 0	12·3		Dec. 5	10 45	14·3
Dec. 14	11 10	12·3		1905.		
29	15 30	12·3		Oct. 31	17 0	14·5
1904.				Nov. 25	15 40	14·9
April 19	9 50	12·2		Dec. 23	14 30	14·8
May 2	7 55	12·1		30	13 10	14·4
3	7 50	12·1		1906.		
Oct. 1	14 45	13·6		Feb. 27	11 30	14·8

These determinations depend upon the magnitudes of the stars given in the measures.

The Nova is now but little brighter than the small star close preceding it (the one thought to be the Nova on the photograph of 1903 February 21). With bad seeing the light of the two stars mixes, and this makes any comparison of the light of the Nova somewhat uncertain. The last observation seemed to be a good one.

The measures of the position of the Nova do not seem to show any certain motion in that object. Nor does there seem to be any indication of a parallax.

Nova Geminorum.

Nova and 1.

1903 Mar.	30	104·82°	32·21″
Apr.	4	105·22	32·52
	6	105·03	32·28
	7	104·97	32 38
	28	104·71	32·66
Aug.	31	104·25	32·10
Sept.	21	104·49	32·52
	28	104·35	32·36
1904 Oct.	1	104·43	32·27
	17	104·38	31·98
Nov.	12	104·94	32·08
	Mean	104·60	32·30

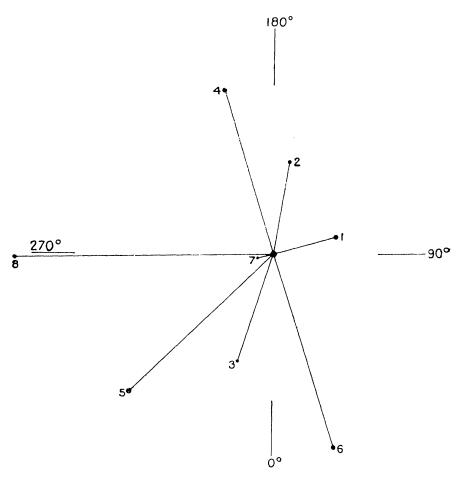| 1905 Nov.	25	104·40°	32·04″	
Dec.	23	104·98	31·44	Very difficult.
	26	103·86	32·22	
	30	105·10	31·89	
	Mean	104·59	31·90	

There seems to be a decrease of distance between Nova and
star 1. This change is not certain, and further measures will be
made to settle the question of motion. If the motion is in the
Nova it ought to tell in the distances of stars 7 and 8 also, and
in the position angles of the other stars.

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Nova and 4.

1903 Mar. 30	196°·15	84″·93	
Apr. 4	196·30	85·15	
6	196·29	84·99	
Aug. 31	196·03	85·07	
Sept. 21	196·14	84·99	
28	196·23	84·96	
1904 Oct. 1	196·14	...	Clouds.
17	196·29	85·06	
Nov. 12	196·52	85·07	
Dec. 5	196·27	84·96	
Mean	196·23	85·02	
1905 Nov. 25	196°·61	85″·06	
Dec. 23	196·87	84·79	
26	196·24	84·93	
Mean	196·57	84·93	

Nova and 2.

1903 Mar. 30	169°·20	45″·66	
Apr. 6	168·78	45·61	
27	168·83	46·31	Uncertain.
Sept. 21	168·72	45·73	
28	168·77	45 54	
1904 Oct. 1	169·52	45·24	
17	169·43	45·54	
Dec. 5	169·34	45·80	
Mean	169·07	45·68	
1905 Nov. 25	169°·36	45″·63	
Dec. 23	169·69	45·25	
26	169·08	45·70	
Mean	169·38	45·53	

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Nova and 6.

1903	Mar.	30	16°·98	102″·81
	Apr.	4	17·45	103·00
		6	17·05	102·86
		7	17·31	102·78
	Sept.	21	16·89	103·13
		28	16·81	102·94
	Oct.	13	17·09	102·93
1904	Oct.	17	17·22	102·76
	Mean		17·10	102·90

Nova and 5.

1903	Mar.	30	313°·86	99″·87
	Apr.	4	313·90	99·94
		6	313·87	99·86
	Sept.	28	313 78	100·11
	Oct.	13	313·80	99·87
		19	313·94	100·03
		26	313·72	99·98
1904	Oct.	17	313·65	99·78
	Nov.	12	313·51	100·05
	Dec.	5	313·63	100·05
	Mean		313·77	99·95

Nova and 3.

1903	Mar.	30	341°·61	55″·69	
	Apr.	27	341·45	...	Too difficult for distance.
	Oct.	26	341·45	55·64	
	Mean		341·50	55·66	

Nova and 7.

1903	Aug.	31	284°·35	7″·83
	Sept.	28	281·61	8·03
	Oct.	26	283·09	7·94
		27	283·77	7·60
	Mean		283·20	7·85

Nova and 8 (14^m ±).

1903	Oct.	26	270°90	131″76
		27	270·83	131·27
	Nov.	16	270·98	131·23
	Mean		270·90	131·42

The accompanying chart of these stars will make their identification easy, even if the Nova should entirely disappear.

High-level Chromospheric Lines and their Behaviour in Sun-spot Spectra.   By A. Fowler.

About a year ago I communicated to the Society an account of some spectroscopic observations of the great sun-spot of 1905 February, and of the prominences observed when the spot was on the Sun's limb.*   An attempt was then made to distinguish

* *Monthly Notices*, vol. lxv. p. 513.